THE CITY OF SAN DIEGO

# MANAGER'S REPORT

DATE ISSUED: July 12, 2000 REPORT NO. 00-141

ATTENTION: Land Use and Housing Committee
Agenda of July 19, 2000

SUBJECT: Portland Cement Concrete (PCC) Streets vs. Asphalt Concrete (AC) Streets

## SUMMARY


Issue - Should the Committee recommend or require all newly built streets be constructed of portland cement concrete pavement instead of asphalt concrete pavement? Currently asphalt pavement is used on most newly constructed streets.

Managers Recommendation - Recommend that both concrete and asphalt pavement options continue to be offered for newly constructed streets.

Other Recommendations - None.

Fiscal Impact - None associated with the Manager's Recommendation. If all newly built streets are required to be PCC, those costs would primarily be born by developers. In turn, those costs could then be passed on to consumers with increased housing costs. While concrete streets may have a longer service life, both initial and rehabilitation costs can be much higher for concrete streets. (see cost analysis on page 3 and Attachment 1)


## BACKGROUND

At the March 15, 2000 Land Use and Housing Committee meeting, a question was raised regarding the type of pavement material (asphalt vs. concrete) being used to build streets in the City. It was requested that an examination of the long term costs of concrete versus asphalt streets be made. Under current City Policy, there are three pavement alternatives which, by varying their thicknesses, can be designed to be equal in design life: A layer of Asphalt Concrete (AC) on a layer of Cement Treated Base (CTB), Portland Cement Concrete (PCC) by itself, or AC by itself. Each of these pavement design alternates is geared toward providing for a minimum twenty-one (21) year service life.

Both AC and PCC have inherent properties that make each desirable under certain circumstances and less desirable in others. Currently, in this region, there are three situations where PCC is a requirement. They are:

1. For steep streets with grades equal to or greater than 12.0%;
2. For alleys and alley intersections; and
3. For new pavement widening of streets when area is 6 ft. or less in width.

While many factors are considered when selecting a roadway material, one of the most significant is cost, both the initial and average annual maintenance cost of the pavement over it's expected design life. The different types of concrete and asphalt available are many, and the costs associated with these different types range considerably. This makes the task of a simple apples-to-apples direct comparison difficult.

Without delving too far into the pavement section variations, for the purposes of the question posed, this report will compare "basic" asphalt with "basic" concrete.

DISCUSSION

A. Before a side by side comparison of the pavement materials is presented, it is important to note three things.

1. ***Currently, per City standards, a specification exists for the option of using either asphalt or concrete as a roadway paving material.*** Developers/Contractors may choose to use either material as they deem necessary. However, in some cases, for the reasons stated above, concrete is required by the City. In most cases, asphalt is chosen by developers and contractors, because of the many factors which are discussed herein. There are cases where concrete is more desirable as the pavement material choice.

2. ***Availability could be a problem if concrete were a requirement.*** While both concrete and asphalt are aggregate and sand (aggregates are crushed rocks of 1/2" to 3/4" in size), concrete aggregates must be of a higher quality. The San Diego region has experienced difficulty in recent years in obtaining high quality aggregates and particularly high grade sand, due to a shortage of this natural material. In addition, demand at this time for concrete is currently stretching local producers to their limit. For instance, the City's Street Division's sidewalk replacement program must order concrete at least two weeks in advance and often cannot get their material delivered without delay.

3. ***Costs associated with exclusivity.*** Should the City require more or all pavements to be constructed using concrete, thereby excluding asphalt, this could lead to higher prices than are currently experienced. The lack of availability of high

quality aggregates would require some to be imported from greater distances, even from outside of California. Most of our sand is manufactured today, as most natural sand sources in the San Diego region have been depleted. The cost of improving and maintaining concrete streets will impact affordable housing, road noise, rideability of the street, length of time to construct, and scheduled maintenance costs.

B. Side by side analysis.

1. Costs.

Typically, concrete has a much higher initial cost, most of which can be recovered over the life of the pavement because of reduced maintenance cycles. However, the cost of repairs, such as, repairing cracks or repairs due to trenching or even rehabilitation at the end of its life, is significantly higher in costs as well. All jurisdictions have had limited success in overlaying concrete constructed streets with an asphalt overlay in order to extend their pavement service life. Therefore, most often a concrete street must be completely reconstructed in lieu of resurfacing. This currently is the situation with many of our deteriorated concrete alleys. Pavement joints require special reinforcing between the asphalt overlay so the overlay is not adversely impacted by the joints transferring to the pavement surface.

Typically, asphalt has a much lower initial cost, and requires more routine maintenance to achieve the desired service life. Slurry seals and asphalt overlay costs add significantly to the life cycle costs. However, these costs are not realized until seven and fourteen years after construction. Therefore, repair and rehabilitation costs are typically much lower than concrete. In addition, when the asphalt streets are overlaid as part of their regular maintenance cycle, a smooth trenchless street is the result. This is impossible with a concrete street.
(For cost, see Attachment 1)

2. Safety.

Older concrete surfaces can be prone to hydroplaning in wet weather due to a lower “coefficient of friction” (skid resistance) than asphalt. This hydroplaning condition can be mitigated with grooving the street, and the grooving would likely have to be repeated during the life of the pavement, thereby increasing its life cycle costs (repeated grooving would be required for streets with speeds of 30 mph or higher). Asphalt pavement however, maintains a higher coefficient of friction (more skid resistance) than concrete over an extended length of time.

3. Environmental Benefits.

Concrete, when it needs to be removed, can only be recycled at a greater cost than asphalt because of quality requirements of materials used for PCC. Asphalt, however, has been an easily recyclable material in San Diego for the last ten years. Being a flexible pavement, asphalt concrete can be mixed with a variety of materials. In addition to recycled rubber from car tires, recent technology has also allowed the use of recycled plastic chips to be recycled with asphaltic concrete. This technology will go a long way toward keeping additional materials out of our land fills.

4. Road Noise.

Concrete is a rigid pavement that due to it's increased hardness and method of placement (concrete is placed with a maximum dimension of 45 ft. in each direction to allow expansion and contraction due to variance in weather temperature) generally creates more road noise than asphalt pavement. In addition, the noise (thump, thump, thump) from the tires of cars passing over expansion joints is often a complaint registered by constituents. Often, these concrete expansion joints create a rougher ride than asphalt.

Additionally, when trenching is performed in concrete streets, the ride becomes even less smooth. The opportunity to correct this with an overlay is not available as part of regular maintenance. It must be overlaid with a concrete white topping that is more expensive than basic concrete and not a part of regular maintenance costs which have already been estimated and factored into the life cycle costs of our pavement comparison.

Asphalt is a flexible pavement and has proven to be much a quieter pavement in terms of overall road noise. In addition, it does not require the expansion joints found in concrete pavements.

Asphalt is a continuous flexible pavement without any joints. Thus it is much smoother to drive over than concrete. When a street is overlaid as part of its regular maintenance, all evidence of street trenching is covered. In addition, when an overlay is performed on a street that has been trenched, the overlay will in part mitigate some of the impacts that trenches have on the service life of the street.

5. User delay during construction.

Concrete pavements, when using "basic" concrete, without additives or add mixtures, must cure days before traffic can be opened to these streets. Even when

using modified concrete the cure time can take up to 6 to 12 hours. This means that these roads must remain closed to traffic until such time that the concrete has cured enough and is able to bear the anticipated traffic loads.

Asphalt pavements can usually be open to traffic within a few hours after paving and results in greatly reduced delays to traffic due to construction. Most concrete pavements must be saw cut for controlled proper jointing, after curing has been partially completed, to prevent natural cracking of the concrete pavement.

6. Summary.

***Inherent characteristics of concrete and asphalt are:*** Concrete has rigid pavement section, significantly higher initial costs, less frequent maintenance and higher rehabilitation costs, need to periodically groove surfaces, less visual contrast for road markings, lower ambient temperatures, not an easily recyclable material, higher road noise, not a continuous pavement (less smooth), more expensive to mitigate trenching, and longer user delays due to curing requirements.

Asphalt has flexible pavement section, lower initial costs, lower maintenance and rehabilitation costs, much greater frequency of maintenance, generally higher skid resistance, greater visual contrast for road markings, higher ambient temperatures, an easier recyclable material, lower road noise, a continuous pavement (more smooth), less expensive to mitigate trenching and shorter user delays due to construction.

As mentioned before, both industries have made strides to change and improve the inherent qualities of their pavement material to make it more attractive. For example, concrete surfaces can be grooved to increase skid resistance and reduce some of the road noise. Construction techniques can be utilized to minimize joint thumps and specialized concrete can be used to substantially reduce user delays. Asphalt, on the other hand, can use special mixes that greatly decrease the need for maintenance by designing mixes that can wear much longer, use recycled materials that are more water resistant and resist water caused breakdown.

All of these things, unfortunately, add to the costs and create a matrix comparison that becomes cumbersome. Instead, it is recommended that no one pavement material become a requirement, but that all three available alternative pavement materials remain an option to the developer, contractor, and the engineer when determining which materials best fit each particular street situation.

ALTERNATIVE

Direct the City Manager to develop a pavement schedule that uses a pavement design service life of more than 21 years without requiring significant surface maintenance. Also, adopt the use of concrete streets as the City pavement standard. Ensure that the new policy be implemented within six months and the necessary appurtenances there to. This standard is to be used by all

who construct streets in the City of San Diego. This is not recommended due to high initial costs associated with such design and thereby potentially driving up the costs of housing.

Respectfully submitted,

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| Hossein Ruhi<br>Chief Deputy Director,<br>Transportation & Drainage Design<br>Engineering & Capital Projects Department | Approved: Frank Belock, Jr.<br>Deputy City Manager |

Belock/Boekamp/rz

Attachment: Cost Comparison Chart - AC vs. PCC

| COST COMPARISON - AC VS. PCC | | |
|---|---|---|
| | **ASPHALT STREETS** | **CONCRETE STREETS** |
| Initial cost per square foot (sf) | $2.20/sf | $4.00/sf |
| Slurry seal at 7 years | $0.05/sf | N/A |
| Slurry seal at 14 years | $0.05/sf | N/A |
| 1-2 inch overlay at 21 years | $0.70/sf | N/A |
| Slurry seal at 28 years | $0.05/sf | N/A |
| Slurry seal at 35 years | $0.05/sf | N/A |
| 1-2 inch overlay at 42 years | $0.70/sf | N/A |
| 50 years concrete replacement | N/A | $4.00/sf |
| Slurry seal at 50 years | $0.05/sf | N/A |
| Total Maintenance cost at 50 years (Present value) | $1.65/sf | $4.00/sf |